Body Paint

Real-time interactive virtual painting created from motion capture dance performance

CIS 499 SENIOR PROJECT DESIGN DOCUMENT

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PROJECT ABSTRACT

Generally, in dance performance, choreographers, lighting designers, or set designers create a setting for a piece: physical constructions, lights and light cues, painted backdrops, pre-created computer backdrops. With new technology, however, backdrops, scenes, and ambiance can be created from a performance instead of imposed upon a performance. Over the last couple decades, many dancers, graphics artists, and computer scientists have explored some of the potential applications of computer graphics and animation to the creation, education and performance of dance. Computers can interpret feedback from the dance performance and create graphical displays or lighting controls based on the qualities of the movement.

Body Paint is a real-time interactive motion-capture program where a dancer will get immediate "feedback" on her movements in the form of a 2-dimensional virtual "painting." The dancer has a variety of options: the quality of the stroke (oil paints, charcoals, or ink, etc.), the view of the "painting," and the way the mapping is generated. Other factors, such as color and weight of the stroke, will be interpreted by the algorithm and based solely on her movement. When performing with Body Paint, not only will the dancer's movement influence the developing image, but the image will in turn influence how the dancer continues moving and uses the performance space.

Project blog:
http://cassandrai.wordpress.com

1. INTRODUCTION

Body Paint will interactively create a virtual painting based on the physical properties (path, velocity, acceleration, and angular velocity) of the movements of the dancer. The default process will do a "conventional" painting – movements will map to a "canvas" at the front of the space. Ideally, there will be two other mappings: a painted "forest" where the motions will be traced and marked in place, with strokes applied, and a moveable cross-section will be projected; and a footwork painting, which only paints from the motion of the footsteps on the ground. These strokes will be selected at the beginning of the piece from a small group: oil paintbrush, ink/calligraphy, and charcoal/pastel. These may also be changed in the resulting painting after the fact. The color of the medium will be interpreted based solely on these properties, although the spectrum can be limited to the dancer's specifications.

1.1. Significance of Problem or Production/Development Need

Body Paint is an artistic tool helping choreographers and dancers intelligently create an ambiance or setting for a piece, rather than imposing an atmosphere. It can be used in performance, choreographed or improvised; or, the dancer can create a painted backdrop to be used for future performances elsewhere.

1.2. Technology

Vicon Motion Systems, ViconBlade, C++, OpenGL, GLUT, projection system.

1.3. Design Goals

1.3.1 Target Audience.

Dance performances generally include some sort of performance environment, with lighting, scrims, painted flats, and occasionally set pieces. Body Paint is a tool for choreographers or solo dancers to create an interesting 2D backdrop for their piece. It can be created during the performance (in theory), recorded to play later, or used as a planning tool for creating the atmosphere (eg, projections and lighting).

1.3.2 User goals and objectives

Users will suit up in the MoCap suit and perform a pre-choreographed or improvised piece. They have many options of stroke to apply to their painting and can redraw it in any other stroke. They also have the option of randomly varying color throughout the painting or maintaining one color throughout. They can alter the staging or choreography of their piece based on the feedback from the painting or simply allow the algorithm to interpret the pre-choreographed piece. Dancers can also use the resulting painting to make design decisions for performance, such as backdrop or lighting.

1.3.3 Project features and functionality

The positions of the dancer's end effectors are streamed into a parser frame by frame. Each marker position is then drawn to the screen using various brushes including Pencil, Calligraphy, Chalk, Ink, Airbrush, or Pointillism. Users can choose to have

2. RELATED WORK

As early as 1985 in the San Francisco Ballet's "Pixellage," computer graphics have been used to generate backdrops for dance performances. Using an Aurora 100 videographics workstation, Darryl Sapien created animated backdrops relating to the pieces choreographed by Betsy Erikson. Some complimented pieces, but others provided props and interacted with the live dancers. [1]

One very extensive performance-graphics collaboration resulted in DigitalBeing. DigitalBeing is an ambient intelligent environment using pressure and physiological sensors to control lighting and projected light imagery to project the dancer's arousal state. [2]

Brushstroke:
DAB: Interactive Haptic Painting with 3D Virtual Brushes
Bill Baxter Vincent Scheib Ming C. Lin Dinesh Manocha

- a deformable, 3D brush model; force feedback
- This paper develops a number of formulae based on physical properties of real painting, eg translucency, blending, wetness, and drying. They solves the problem of creating realistic brushstrokes by modeling brushes in 3D and applying various physical equations to the resulting stroke. It is considerably more complex than my current needs.

Artistic Reality: Fast Brush Stroke Stylization for Augmented Reality
Jan Fischer Dirk Bartz Wolfgang Straßer

- Pointilistic result on video/real images

Painterly Rendering with Curved Brush Strokes of Multiple Sizes
Aaron Hertzmann

- creating an image with a hand-painted appearance from a photograph
- brush sizes for expressing various levels of detail
- "We model brush strokes as anti-aliased cubic B-splines, each with a given color and thickness. Each stroke is rendered by dragging a circular brush mask along the sweep of the spline."

Sketching with a Low-latency Electronic Ink Drawing Tablet
Alex Henzen Neculai Ailenei Fabian DiFiore Frank Van Reeth John Patterson

- Sketching tablet to mimic real-life drawing/sketching
- Smooths curve a la clean-up artist
- Instead, a high-level internal representation, using cubic Bezier curves, is created, using the classical formula

Essentially, few contemporary papers concern themselves with applying 2D strokes to paths. Generally, they are more concerned with painterly rendering from images/video or 3D brushes. However, these have proven useful in: 1) showing me the potential complexity involved in creating realistic brushstrokes and 2) helping devise a method of abstracting from the data, specifically using Bezier curves.

3. PROJECT DEVELOPMENT APPROACH

3.1. Algorithm Details

Rendering Brushstrokes:

i. Pencil
ii. Calligraphic
iii. Ink – tapering, solid color
iv. Chalk – patchy
v. Airbrush – fade to transparent
vi. Pointilistic – random pixels in radius, with complementary color

Color Variance:
Randomly select new R, G, and B values
Set as Target color
Interpolate between current color and target color until target color is reached
Repeat from top

RealTime:
Although RealTime streaming never completed successfully, I did learn the process to connect to the server and request data.

1) Capture Range Of Motion starting and ending in T-Pose
2) Process ROM and label markers for skeleton
3) Configure the appropriate skeleton and calibrate character
4) Turn on the RTE (check box in RealTime window), change to solving data, and replay last
5) Connect to RTE on port 801 using ExampleClient cpp code in SDK
6) Send an ERequest for data using ExampleClient (type and packet)
7) Position of markers and joint angles are stored in markerPositions and bodyPositions in ExampleClient and available for use
8) Loop from 5 until finished streaming
9) Disconnect

Range of Motion should should the full range of motion of each joint in the skeleton.

Parsing:
The following ASCII txt file is of a C3D file from a 41-marker capture. It looks like this:

```
# Pts =        330
# Video Frames =             817

Video Frame #                1
 1           -362.6837      43.40683      1576.704
 2           -391.7587     -107.3856      1560.726
 3           -488.6526      53.48709      1578.006
 4           -519.5791     -71.79614      1573.069
 5           -554.4143      20.64053      1427.9
 6           -596.244       49.57842      1269.839
 7           -430.8454     -20.91483      1346.435
 8           -374.684      -60.96157      1146.681
 9           -628.6105     -39.1553       1339.783
 10          -446.8915      154.9754      1386.962
 11          -442.9143      271.4127      1194.888
 12          -451.0745      311.3223      1064.325
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42	-543.6483	2.262916	927.4525
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318	-484.3325	262.7725	825.7585
319	-498.4586	249.9493	796.6834
320	-495.2357	241.2405	798.9464
321	-501.9558	240.4862	805.7351
322	-505.1788	249.195	803.4722
323	-711.5841	-178.7703	820.1354
324	-702.5324	-177.1246	824.867
325	-707.264	-171.0901	831.8615
326	-716.3842	-172.7359	827.1299
327	-705.8925	-149.7639	799.0149
328	-696.7723	-148.1181	803.7465
329	-701.5724	-142.0837	810.7409
330	-710.6241	-143.7294	806.0094

Video Frame #		2	
1	-361.3808	4.44681	1576.429
2	-389.8386	-107.9342	1560.863
3	-487.4183	52.80136	1578.006
4	-518.4819	-72.61902	1572.932
5	-553.18	20.22909	1428.037

```
6           -596.1068      49.44128      1270.387
7           -430.7768     -21.18912      1346.366
8           -373.5868     -61.23587      1146.612
9           -628.062      -39.36102      1340.195
10          -445.7258      154.4954      1386.962
```

The format is “markerNumber X Y Z” within a frame. Each frame is notated with “Video Frame # frameNumber”. Pseudocode for parsing:

```
Read in the number of Markers and number of Frames
While not end of file
        Extract LFIN, RFIN, LTOE, RTOE from frame
        Tokenize line
        Add [x1,y1,x2,y2,x3,y3,x4,y4] to frame
```

3.2. Tools used

3.2.1 Hardware

Vicon Motion Capture system, projection display

3.2.2 Software

OS: Mac, OpenGL, GLUT, ViconBlade

4. WORK PLAN

4.1.1. Project Milestone Report (Alpha Version)

- Exhaustive literature review on similar Dance/MoCap projects
- Exhaustive literature review of 2D brushstroke algorithm and refinements
- Thorough brushstroke algorithm outline and pseudo-code
- Some Vicon training and familiarization

4.1.2. Project Final Deliverables

- Resources for future Vicon Blade development and troubleshooting
- Fully functional drawing application which can use mouse input to paint
- Six brushstrokes for painting: Pencil, Calligraphy, Chalk, Ink, Airbrush, and Pointillism
- Random color variability option
- Loading, parsing, and interpreting ASCII txt converted c3d files

4.1.3 Project timeline.

1. Background research
    a. Similar dance projects
    b. Brushstroke algorithms
2. Learn Vicon hardware and ViconBlade software
    a. Training
    b. Practice running the system
    c. Figure out realtime engine and needs regarding filetypes and skeletons
3. Creating brushstrokes

        a. Read similar 2D algorithms
        b. Code up and fine tune brushstroke algorithms
            i. Pencil
            ii. Calligraphic
            iii. Ink – tapering, solid color
            iv. Chalk – patchy
            v. Airbrush – fade to transparent
            vi. Pointilistic – random pixels in radius, with complementary color
4. Combine MoCap and brushstrokes
    a. Write a parser for an ASCII txt file of a c3d file
    b. Apply stroke to path created from c3d file (x,y,z)
    c. Adjust effects on color, width, canvas position
5. User trials/Results!

5. RESULTS

File Preparation
Use C3D Data program to convert *.c3d to *.txt (Program is available from here: ftp://c3dftp:c3dftp@ftp.c3d.org/user/c3d-data.exe)

Work Environment Setup (Mac OSX)
1) Open project in XCode
2) Ensure the following frameworks are included:
    a. GLUT, AGL, Carbon, OpenGL, ApplicationServices
3) Input requests path to .txt file, e.g.
    /Users/Cassandra/paintbrush/MoCap/05_10_markers.txt

Control (Mac OSX)
F1 – fullscreen
g – draw parsed motion!
m – toggle mouse drawing on/off
c – toggle color variance on/off
r – refresh screen (blank canvas)
1 – Pencil
2 – Ink
3 – Chalk
4 – Calligraphy (tends to crash program, be careful!)
5 – OilPaint alpha version
6 – Pointillism
7 – Airbrush

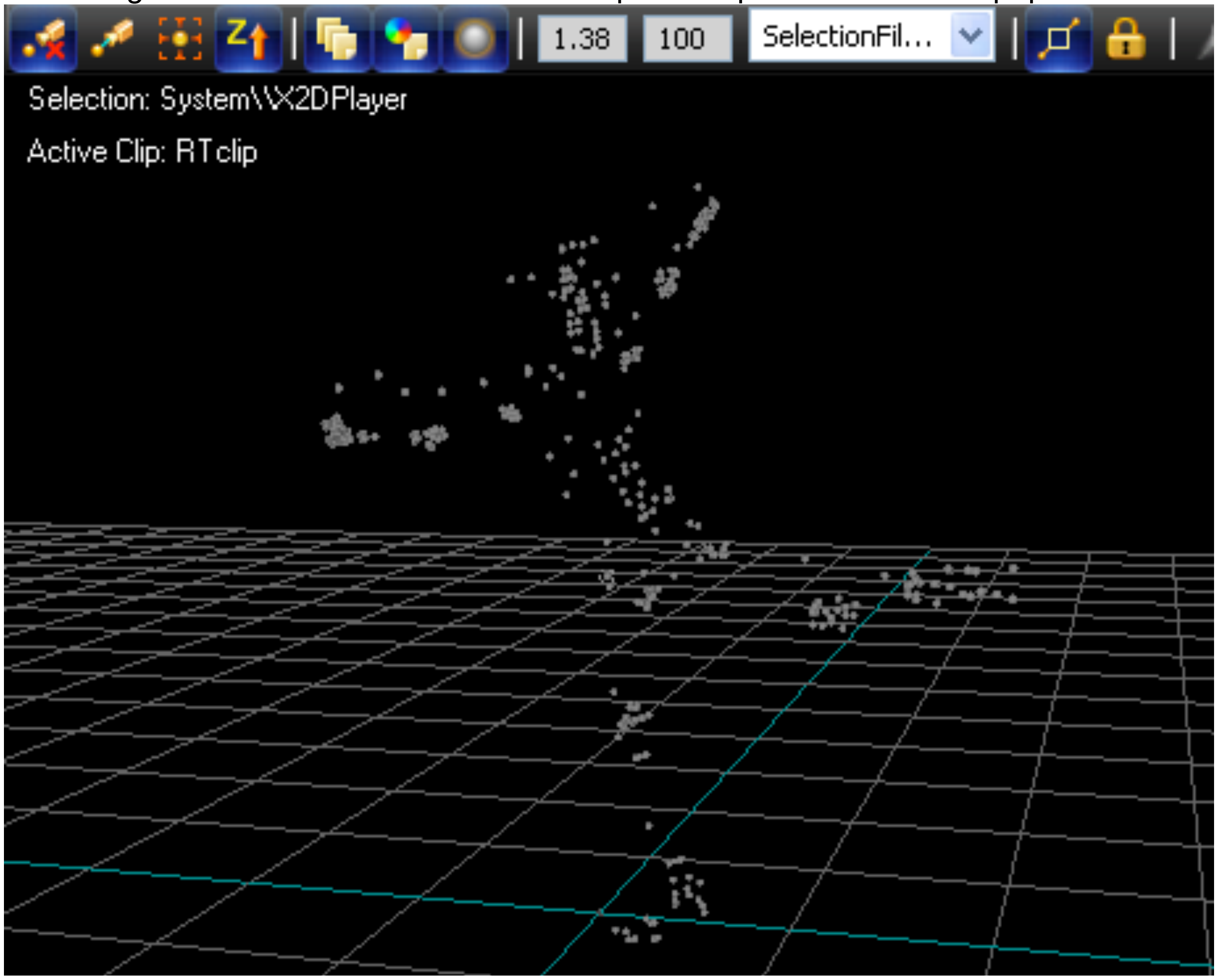
Problems:
Vicon Blade:
-Flickering Markers
-Bad automatic labeling and solving
-Errors loading skeletons

-Unable to calibrate characters
	e.g. “Constraint RIHAND_R_Wrist has no parameters. Its offset will not be altered by calibration.”

RealTime:
-*port 801*
-ExampleClient code: EInfo, ERequest yielding bad packet and type

Brushes:
-Structure

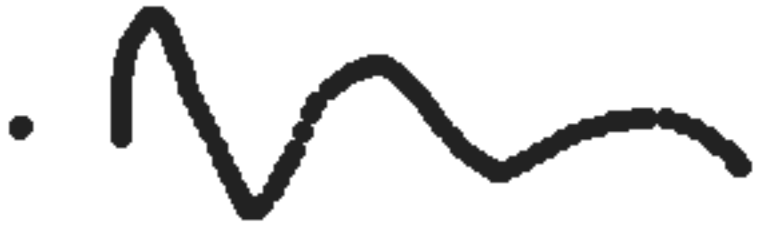
Motion Capture:
-File types:
C3D adds many points and the parser does not label them. This code only works on files using the same marker set as CMU. http://mocap.cs.cmu.edu/info.php

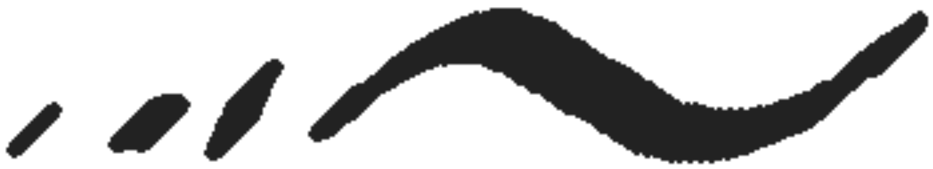


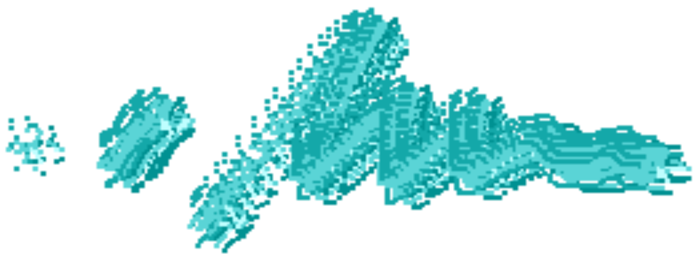
Selection: System\\X2DPlayer
Active Clip: RTclip

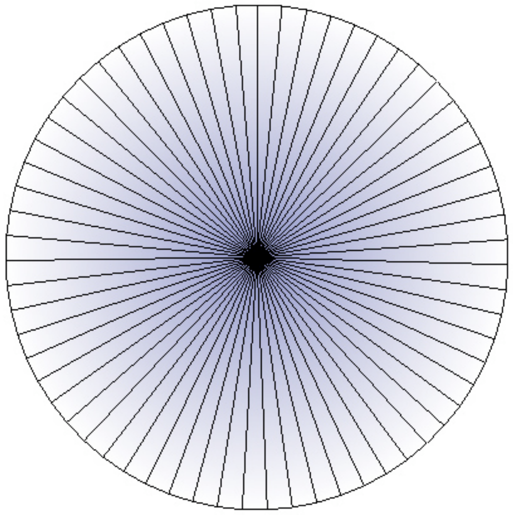
Parser:
-Structure

Results:
Brushes from Mouse Input

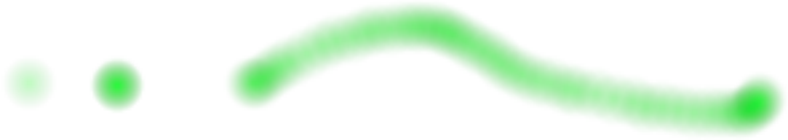

Pencil


Calligraphy

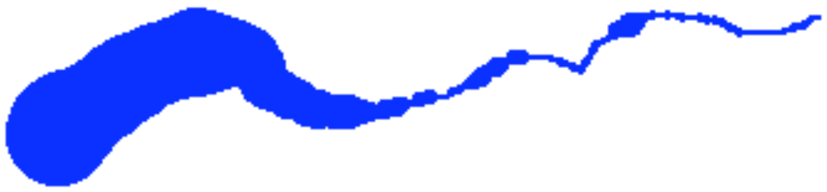

Chalk



Airbrush introduced me to the concept of transparency from a coding perspective. OpenGL has alpha channels as a built in structure to blend a newly drawn pixel with the pixels behind it. Each point is a triangle fan drawn with an alpha value of .5 in the center and 0 at the edges. See picture at left: the triangle fan is drawn over this purple Airbrush stroke shape.

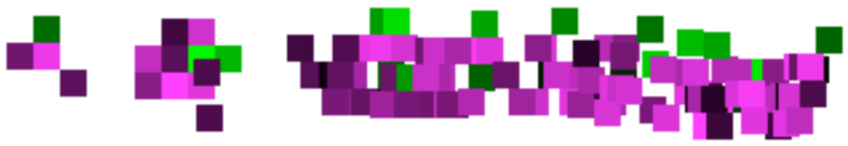


Airbrush



Ink

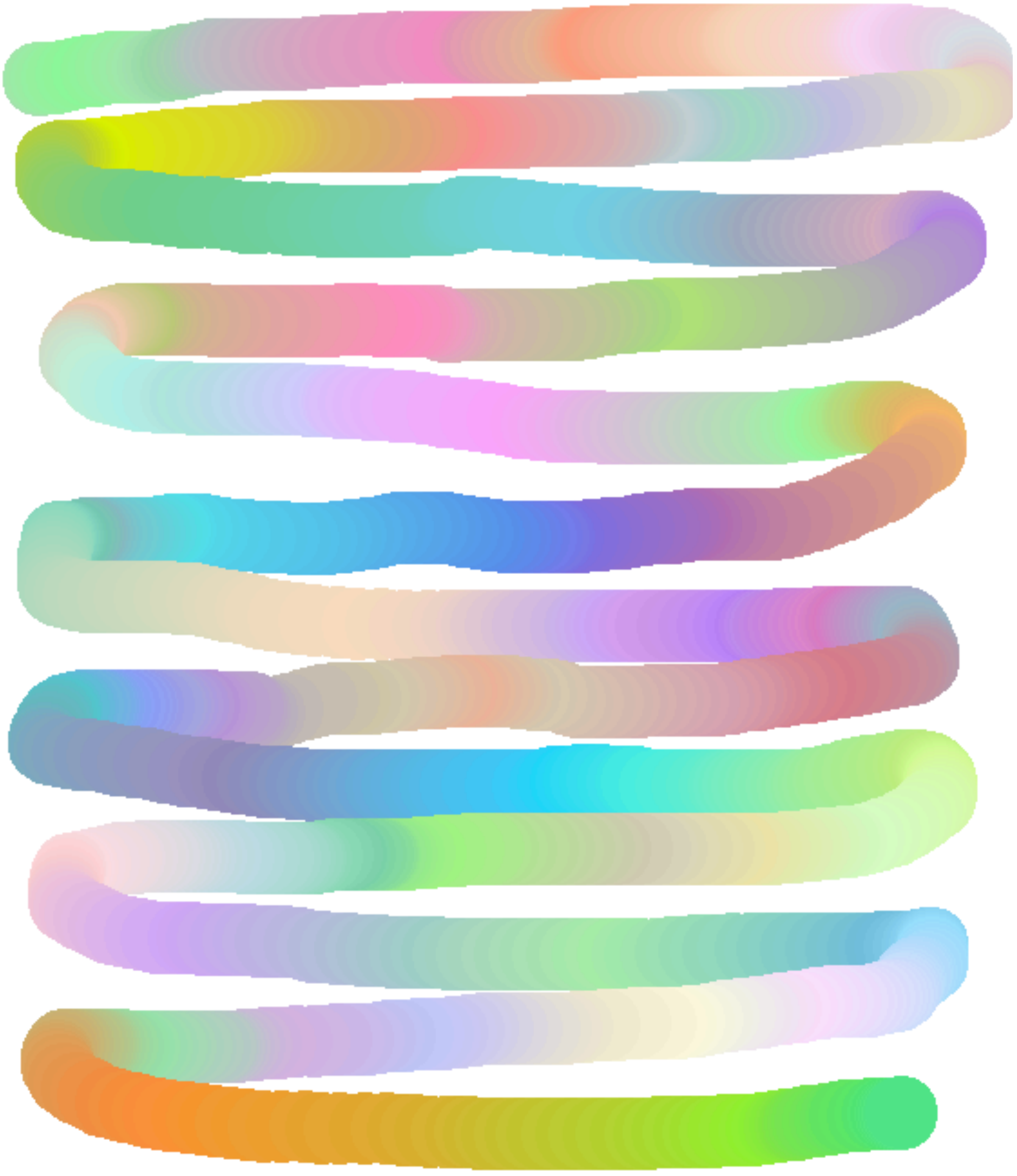
Originally, I considered Ink and Calligraphy under the same heading. I later realized Ink was more about variability in size of stroke while Calligraphy was a standard, slanted brushstroke repeated in the same size. Ink resizes dynamically with the speed of the stroke: faster movement enlarges the stroke, and slower movement shrinks the stroke. Minimum and maximum radii are preset.



Pointillism

Inspired by the seminal work of Georges Seurat and the Pointillist movement, this brush paints small squares in different values to the screen. The algorithm selects a random point within the brush radius, and draws a relatively sized square in the current color with randomly selected value (in painting, amount of black in the color). One-fifth of the time, it also paints a random square of the complementary color. Above, the color is magenta and the complementary color is green.

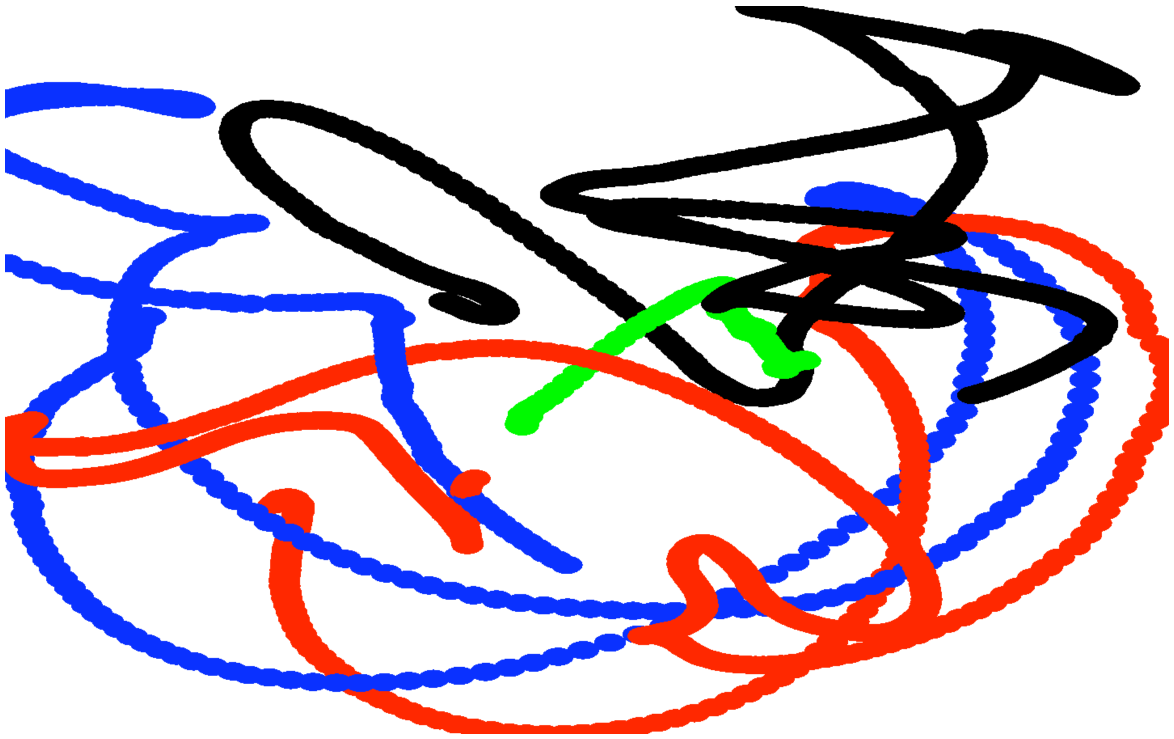
Random Color Changing



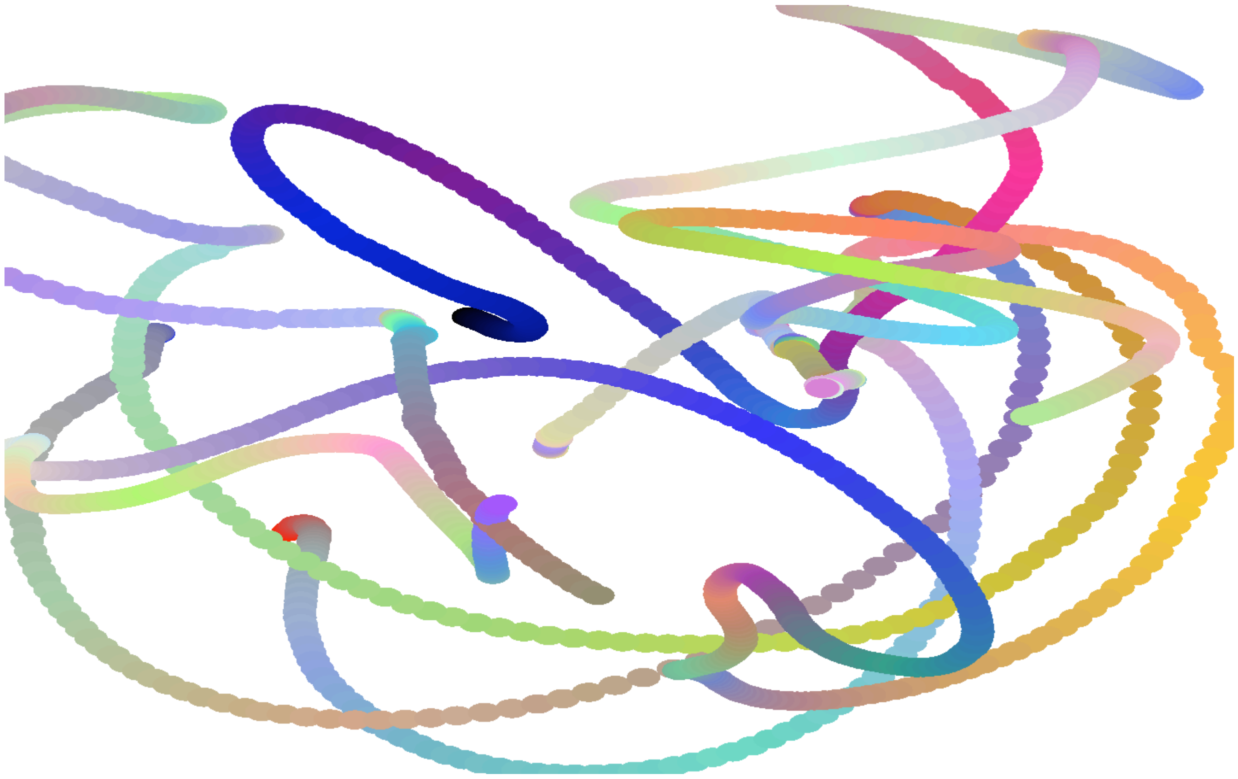
Brushes with MoCap Input
File: MoCap/05_10_markers.txt
dance - glissade devant, glissade derriere, attitude/arabesque

Left hand = black	Left toe = green
Right hand = red	Right toe = blue

Pencil stroke

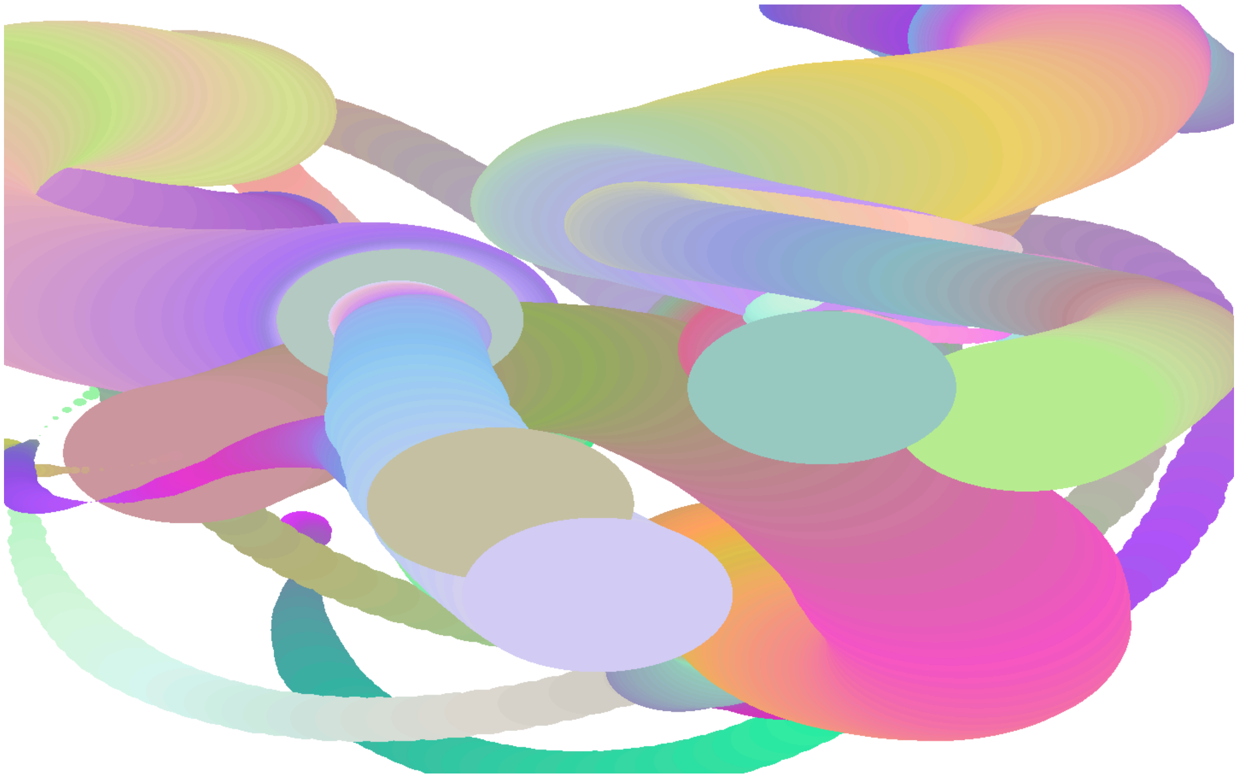


Pencil with color variance

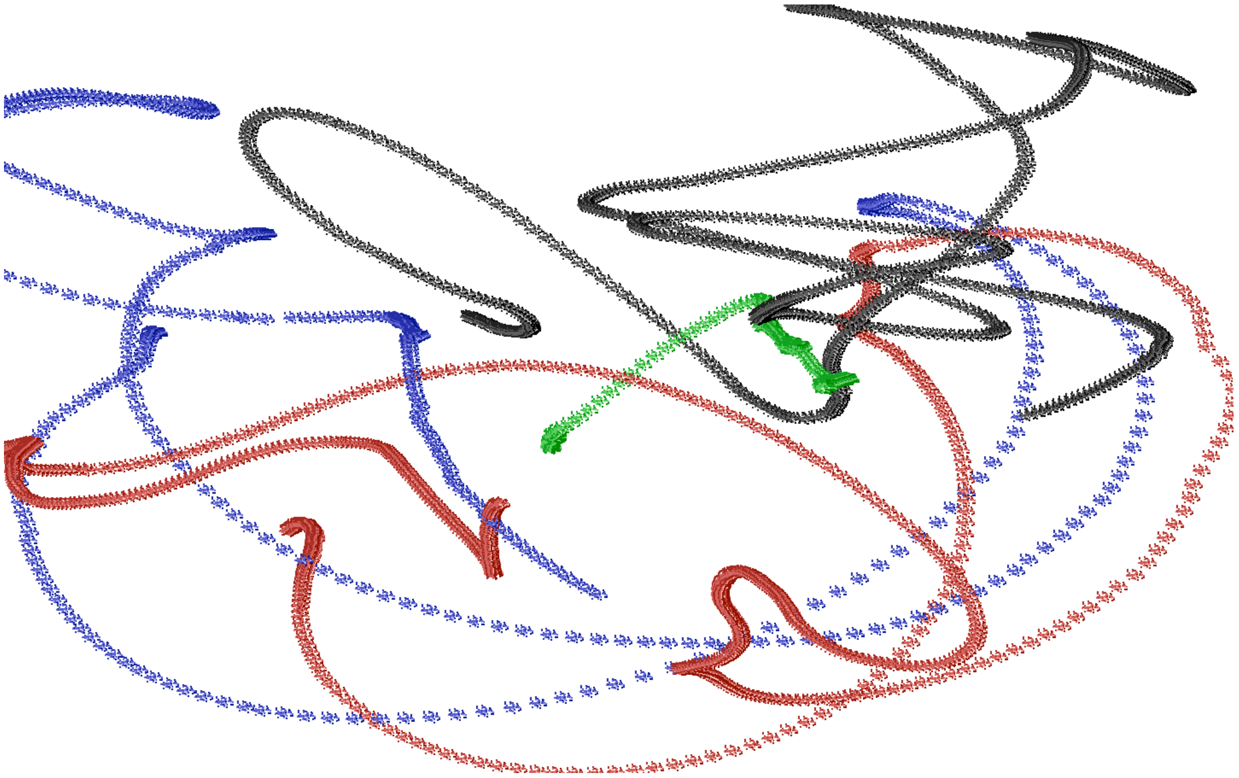


Ink

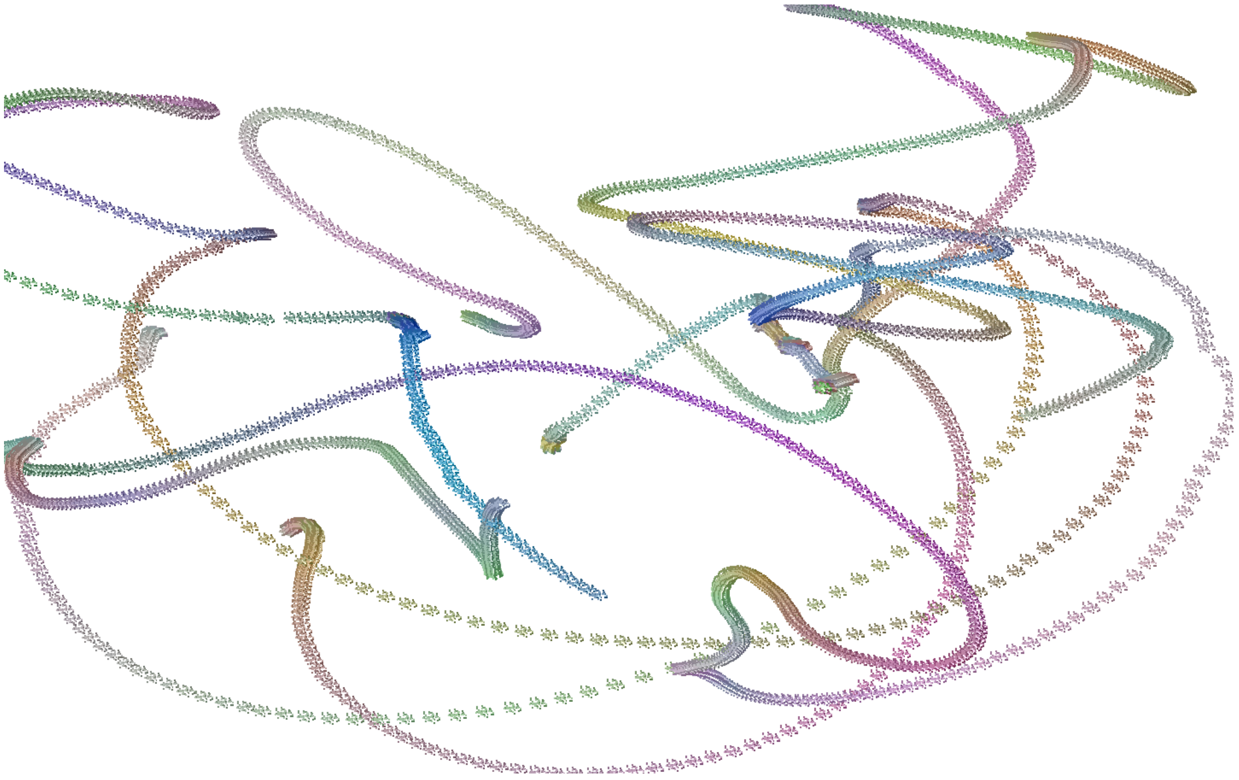
Ink with Color variance



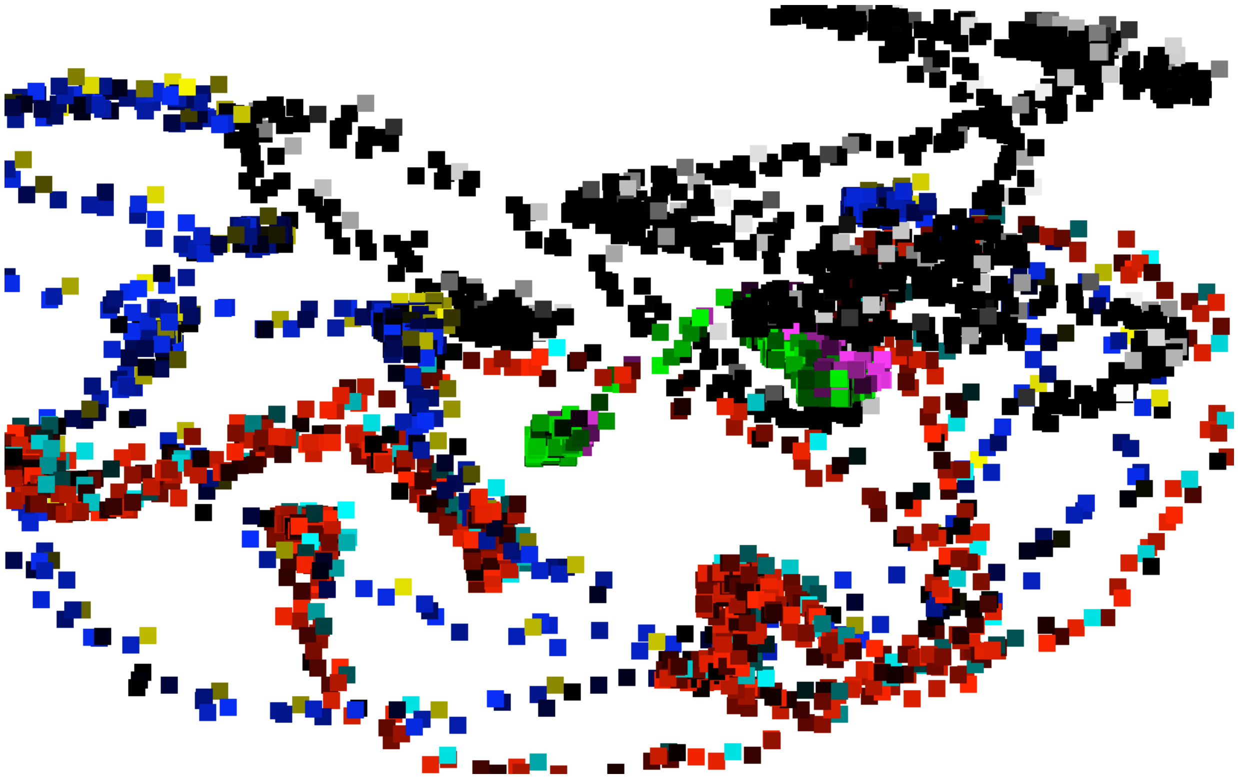
Chalk



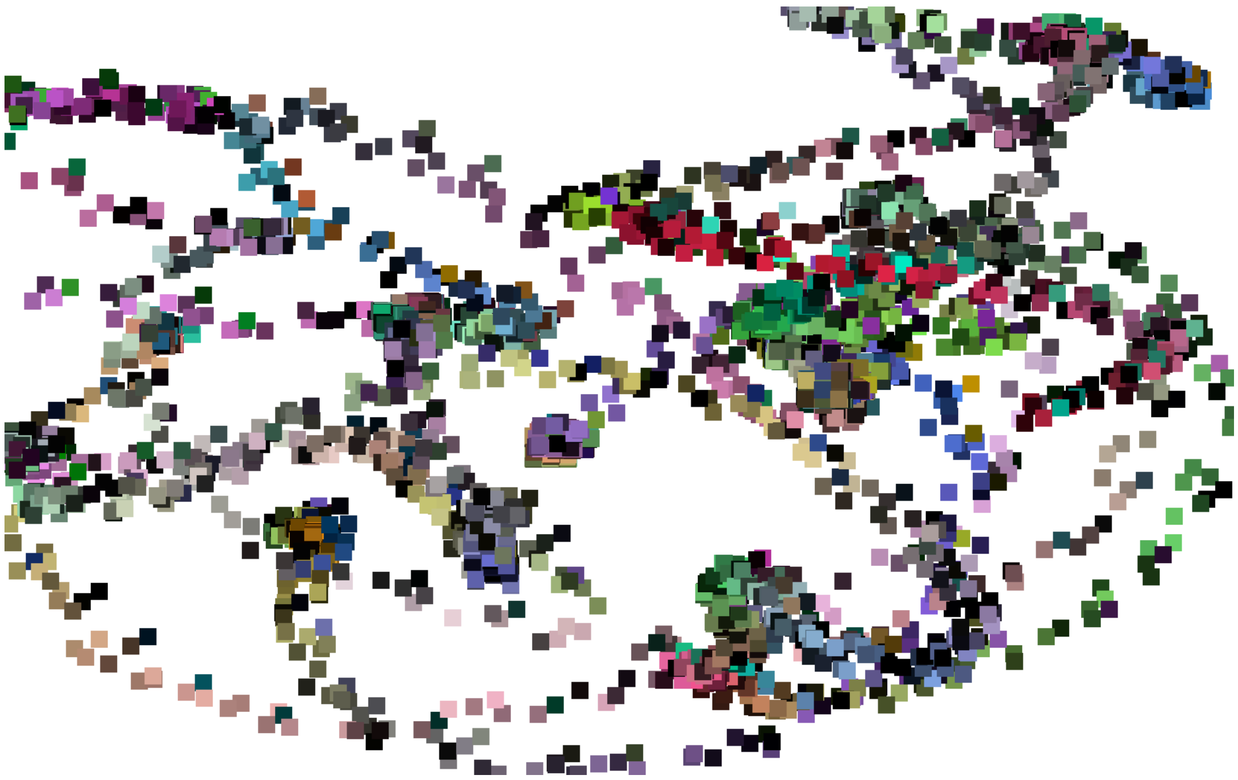
Chalk with Color Variance



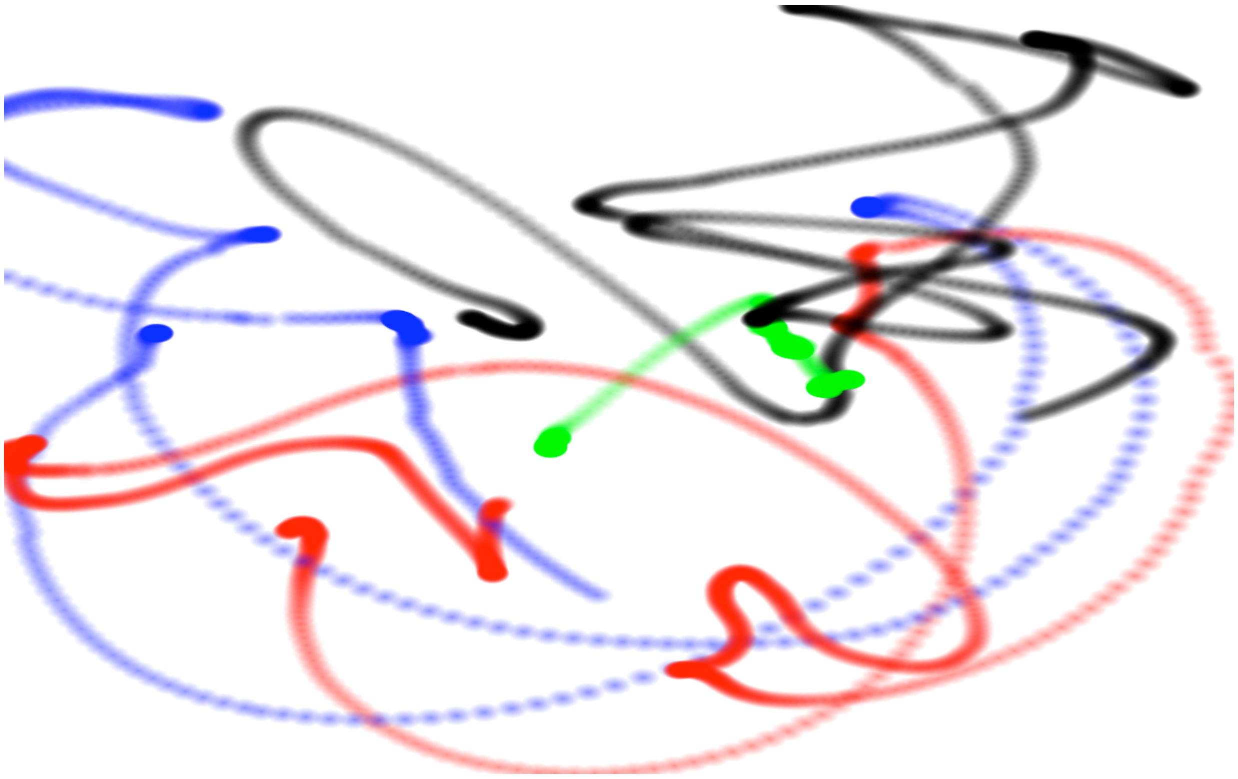
Pointillism



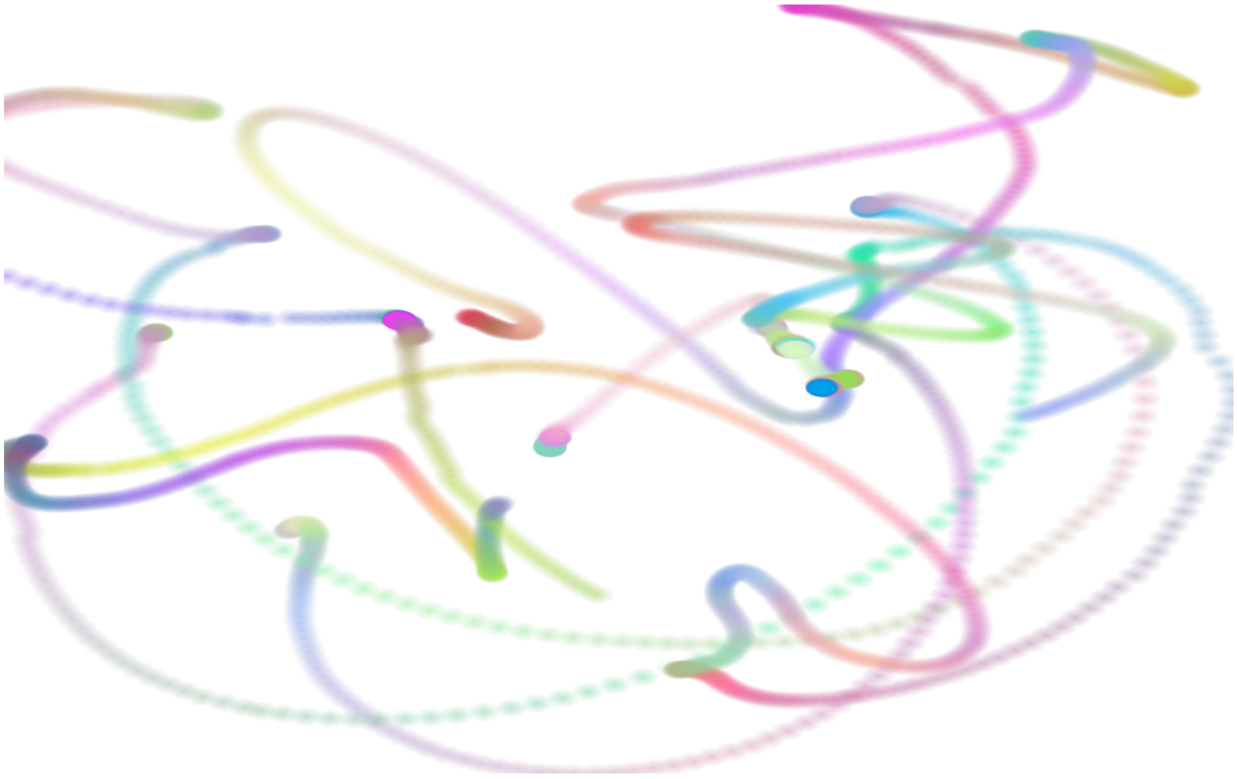
Pointillism with Color Variance



Airbrush



Airbrush with Color Variance



More images from different motions are located in the MoCapResults folder of my project! Check them out!

All motions are from CMU MoCap database subject #05.

6. FUTURE DIRECTIONS

Given indefinite time and resources, this project could go in innumerable directions. Some of the most interesting ones are:

RealTime Engine:
Because so much of the concept behind this project was based on a fascination with realtime interaction and how feedback influences our artistic decisions, succeeding in connecting to the RealTime Engine, requesting, and recieving data

User Interface:
-The current setup is not user friendly, only end-result friendly. I would like to add a small GUI to select options before painting (whether painting from pre-captured data or in realtime). However, while painting, only the "canvas" will be visible for artistic coherence.

User Study
Naturally following from the Real Time and UI are user comments on the program and their likelihood to use the program for different reasons. I would sample from dancers, choreographers, actors, and non-performers to get an idea of other possible applications of similar programs for other audiences as well as the success of this program for different audiences.

Viewing Planes:
-I would love to add alternate viewing/mapping planes. Mostly, I would love to see a 3D painting from the captured motion. The difficulty here is

Brushes:
-Use input points as control points for curves (B-spline, Bezier). The main difficulty here is knowing when to start and stop a curve because there is no LbuttonDown call when motion capturing.
-Painting with different colors or brushes with different end effectors.
-Adding an oilpaint brush that uses dynamic sizing during one stroke and also shades to capture light on paint.

AMC/ASF files
-Although parsing MoCap files was not what I had in mind, having parsed ASCII txts of C3D files, I think it could be helpful to also accept ASF/AMC pairs or BVH files (which are all ASCII files), extract the motion data, and create a painting. This way, motions captured on other systems can be used later to reflect on the choreography or performance.

7. CONTRIBUTIONS

Vicon: learning Blade, learning about connecting to servers, learning about realtime capabilities, learning about marker sets and skeletons,

Virtual Painting:

Learned GLUT, learned more OpenGL

ASCII txt of C3D file parser
Procedurally generated Virtual painting

8. REFERENCES

Guides:
Vicon RealTimeSDK Manual
http://bdml.stanford.edu/twiki/pub/Haptics/MotionDisplayKAUST/RealTimeSDKmanual.pdf

Vicon RealTime Data
http://grouplab.cpsc.ucalgary.ca/cookbook/index.php/Toolkits/ViconRealTimeData

CMU Database: http://mocap.cs.cmu.edu/

Info on C3D files: C3D.org

Blade Help Files

MoCap file interpretation: http://www.tabinda.net/mocapsim/software2.htm

Academic Papers:
[1] F. Crow and C. Csuri, "Music and Dance Join a Fine Artist and a Paint Machine," IEEE Computer Graphics and Application, pp. 11-13, 1985.

[2] El-Nasr, Magy Seif and Thanos Vasilakos. “DigitalBeing: an Ambient Intelligent Dance Space,”

[3] Meador, W. Scott, Timothy J. Rogers, Kevin O’Neal, Eric Kurt, and Carol Cunningham. “Mixing Dance Realities: Collaborative Development of Live-Motion Capture In a Performing Arts Environment.” ACM Computers in Entertainment, Volume 2, Number 2, April 2004.

[4] Baxter, Bill, Vincent Scheib, Ming C. Lin, and Dinesh Manocha. DAB: Interactive Haptic Painting with 3D Virtual Brushes.

[5] Fischer, Jan, Dirk Bartz, Wolfgang Straßer. Artistic Reality: Fast Brush Stroke Stylization for Augmented Reality.

[6] Hertzmann, Aaron. Painterly Rendering with Curved Brush Strokes of Multiple

Sizes.

[7] Henzen, Alex, Neculai Ailenei, Fabian DiFiore, Frank Van Reeth, John Patterson. Sketching with a Low-latency Electronic Ink Drawing Tablet.

9. Work Log

Week 1 (Jan 25, 2009 – Jan 31, 2009) – This week involved meeting with Joe and Alla and getting some feedback. The most significant part I had not really considered was file format (I considered physical data, eg would I use position or joint angles/skeleton or something else?). Both Alla and Joe directed me to CMU's mocap database and resources/tools available there. I also realized I really ought to do a formal user study to get feedback for final tweaks and future plans for the project.
Finally, I continued amassing and skimming through papers related to dance-MoCap, to follow-up on shortcomings of my original design document.

Research Summary
January 22, 2009

Project Abstract

Over the last couple decades, many dancers, graphics artists, and computer scientists have explored some of the potential applications of computer graphics and animation to the creation and performance of dance. Body Paint is a real-time interactive motion-capture program where a dancer will get immediate "feedback" on her movements in the form of a 2-dimensional virtual "painting." The dancer has a variety of options: the quality of the stroke (oil paints, charcoals, or ink, etc.), the view of the "painting," and the way the mapping is generated. Other factors, such as color and weight of the stroke, will be interpreted by the algorithm and based solely on her movement. When performing with Body Paint, not only will the dancer's movement influence the developing image, but the image will in turn influence how the dancer continues moving and uses the performance space.

Week 2 (Feb 1, 2009 – Feb 7, 2009) – I began collecting papers regarding brushstrokes and realized how overwhelmingly vast a topic that is. Many seemed far more complicated than what I needed, and others working toward such an unrelated goal as to be irrelevant.

Week 3 (Feb 8, 2009 – Feb 14, 2009) – I spent some time looking through the CMU database and resources. I conveniently found they have at least one subject with 10 or so captured dance motions.

Update on outline and some new details
February 8, 2009

Because my abstract was not super detailed, here's the intro for your perusal:

Body Paint will interactively create a virtual painting based on the physical properties (path, velocity, acceleration, and angular velocity) of the movements of the dancer. The default process will do a "conventional" painting – movements will map to a "canvas" at the front of the space. Ideally, there will be two other mappings: a painted "forest" where the motions will be traced and marked in place, with strokes applied, and a moveable cross-section will be projected; and a footwork painting, which only paints from the motion of the footsteps on the ground. These strokes will be selected at the beginning of the piece from a small group: oil paintbrush, ink/calligraphy, and charcoal/pastel. These may also be changed in the resulting painting after the fact. The color of the medium will be interpreted based solely on these properties, although the spectrum can be limited t the dancer's specifications.

Now, some elaboration and new knowledge:

To begin with, a little while ago, I met with Joe and Alla to go over my design doc and my basic idea. Some things I did not know/have reconsidered/adjusted:

Motion Data

CMU has an exquisite database of captured motions, including, dance motions! (http://mocap.cs.cmu.edu/ – note subject #5) This will be a great resource when testing out strokes and mappings. It has also been helpful (and will definitely continue being helpful) for figuring out the Vicon system and its methods.

Data Format

Before I can really get to mapping the movement to a path and applying a stroke, I need to think about file types. I've never worked with recorded mocap data, just real-time, so I didn't think too deeply about how the data was stored. I knew the system located a series of hyper-reflective balls in 3D space. I now know this data is then translated into joint angles for most later levels of processing. I am currently leaning to the raw-er data of c3d, with simply the positions of the markers. However, I need to figure out how to read the data in any file type used. CMU has an .asf/.amc reader. The software "ViconIQ" that comes with the system processes the camera data and ultimately outputs a .vsk/.v. I am unsure as of now in what data formats Vicon captures/processes/records in real time and which one is ideal.

User Interface

First and foremost, I should begin planning this out presently, not toward the end was originally prescribed. To that end:

I do not want it to use gesture recognition. Gesture recognition requires new learning that is orthogonal to the actual goal (creating a virtual painting by dancing). Instead, I would like a conventional and usable interface on the home machine of the software, something simple and intuitive for the accepted, learned interaction with GUIs. It will be a short series of choice:

* What stroke would you like to use?: Oil paint, calligraphic ink, charcoal or pastels

* What color range? Select range of hue, saturation, and value
* What kind of mapping would you like to use? Conventional canvas(movements are interpretted as strokes on a virtual canvas at the “front” of the 3D dance- space, regardless of “depth”), 3D painting (paths follow the movement in 3D space with a moveable viewing plane that can cut through the space anywhere), or footwork (only motion that contacts the floor will leave a path, resulting in something more like pointilism)

These will be a conventional, simple interface on the base machine. Once the dancer has selected her choices, she will get in place to begin her piece, and the technician will select an option to start recording.

After completing the piece, I would like the dancer to be able to change the stroke or color selection to see other resulting paintings.

Notes:

-Joe recommended using prerecorded bvh files (such as those available from CMU) to show off the various strokes in the interface.

-If I get different mappings working as intended, I want to demo the resulting “painting” in the interface – ie, a 2D painting, a 3D painting, or a “floor” painting from the same dance.

User Study

-In my head, I assumed I would ask people to come in and try it out and give feedback. I should clearly formalize this and include it in my deliverables. This is a project about user experience, after all.

QUESTIONS:

Brushstroke Algorithms:

-I am having some trouble finding useful papers for simple implementation of stroke algorithms. I find all these papers on painterly rendering which seems more complex than required, and some on different interfaces or applications, but none simply on taking a path and applying an artistic stroke, a la Photoshop and Illustrator. I remember some things on defining curves from Intro Graphics which I could probably use to smooth the strokes, but regardless, I need algorithms for the strokes so I can get onto implementing them. I’d appreciate any help parsing through the vast literature on this and related topics to narrow down to very relevant topics. I will keep looking, but I feel like these are pretty standard, I am just not exposed to them.

I am a bit behind, but I have reworked my schedule to optimize catching up and getting back on track.

Posted in Overview | 3 Comments

Week 4 (Feb 15, 2009 – Feb 21, 2009) – Friday Feb 20 was Vicon training day where I learned what is different about our system from the one I used and got a refresher on calibrating and capturing. I learned we do not currently have a set suit, which I would prefer. However, as an ex-dancer, I own a surprising amount of spandex that can be used. I also have access to the PACshop which, I believe, may have some lycra suits.

Week 5 (Feb 22, 2009 – Feb 28, 2009) – Due to fairly unfruitful initial searches into how on earth to write these brushstrokes in efficient and simple algorithms (just the basis, not the coloring or variation), I continued my literature search and decided that I am simply not going to find as clear a reference as I was hoping. So it seems when I get back, I will be thrusting myself blindly head-first into choosing a windowing system and applying stroke algorithms to mouse data.

Week 6 (Mar 1, 2009 – Mar 6, 2009) – Compiling the Alpha review. Takeaway from Alpha meeting with Joe: working with brushstrokes, printing out coordinates in realtime, meet with Alla after spring break as soon as possible.

Weeks 7&8 (Mar 16, 2009 – Mar 28, 2009) – Tried to arrange Alpha meeting with Alla, however she got sick and we had to postpone until Mar 31. I set up the coding environment for brushstrokes, but it's buggy.

Week 9 (Mar 29, 2009 – Apr 4, 2009) – Finally had Alpha meeting with Alla on Mar 31.
MoCap realtime print out-does it need to be on a different machine?
-how to connect from same machine?
Adding on top of buffer instead of refreshing?
Start with dots and brushstrokes
Then working from c3d data
Find c3d parser!!

Tried capturing data and configuring/calibrating it with Blade. Very very bad auto-solving and incredibly flickery points.

Week 10 (Apr 5, 2009 – Apr 11, 2009) –

Fri, Apr 10, 2009 at 4:51 PM Got the videos from Joe on ViconBlade. Realized that the data is streamed directly out by the RTE and worrying about file types like c3d or bvh is an unnecessary processing step which will interfere with runtime latency.

Finally debugged my GLUT errors. I was having issues drawing anything to the screen. Converted coordinates from mouse to view.

Week 11 (Apr 12, 2009 – Apr 18, 2009) -

Tue, Apr 14, 2009 at 1:58 PM

Also, I tried to watch some of the movies at home over the weekend but, evidently, I lack a plugin but quicktime never specifies which plugin so i didnt know what to install and figured i will just try to watch in the lab this week.

-Spent a bunch of time figuring out Sockets and Ports and connecting to servers. Watched a lot of Blade videos, and multiple times.

Week 12 (Apr 19, 2009 – Apr 25, 2009)
Sun, Apr 19, 2009 at 5:12 PM

It turned out not quite as successfully as I would have liked (I would have emailed you but I have literally been going straight since then.) The rest of thursday, I could not get a skeleton to load to my points (I don't know Nexus as well) and Michael was there wanting to film some MoCap for those TVs, and I only wanted to hold him up so long, so I had him film just the markers and me dancing around, and then I had a meeting to go to so I closed everything down. When I went back on Friday, I tried playing with Blade and the RTE and getting the code to run and looking up more things about that and did not make any legit progress in the time I had. I tried to find stuff on socket errors and stuff on running Vicon in real time. The only thing I may have found was that I might need to make a skeleton or object for what I want to do in order to run the RTE. I also tried to do this (make a skeleton or object) and though I found where you can make one, I couldnt figure out how to specify stuff about it (again, didnt have loads of time). So this means:

1) Trying to figure out what's giving us that Socket error in the sample client code

2) Watch more of the videos on RTE and, evidently, making skeletons/objects.

3) Make a skeleton or object for my code

4) Get the real time thing working and pumping out the x y zs like it should and hook it up to some brushstroke code.

5) Rework my brushstroke code because it's a bit convoluted right now.

6) Make brushstrokes prettier.

7) Play with color and weight.

The last 3 were more for myself than for you. I was kind of on a roll... anywho, I will be there tomorrow at 5. Hopefully you are there in case you have any good ideas for stuff, but if not, it's a good environment for me to work on the brush stuff. I know, normal people leave at 5. Hopefully we'll overlap?

Tue, Apr 21, 2009 at 7:22 PM
I got some of it working! I can explain more later, but the long and short is that I did get a blade skeleton to map to the markers. I saved the range of motion capture that mapped, if weakly, to a skeleton. Main problems:

-I don't know what the marker set actually is for this skeleton.
-I forgot to wear the hat and so have no head markers (not that I care, but the skeleton does)
-I try to get the RTE to work like it says to for motion builder, but when i replay last capture, nothing plays in the perspective window. I also noticed that noting would show up in the perspective window except after processing the ROM/associating them with a skeleton. Ideas?
-I actually can't figure out how to relabel mislabelled markers. The main solve is good but, because of missing the head and not knowing the marker set, it's a bit wonky. But it does work. Significantly less flickering.

Oh, and once I did the supposed steps to connect to the RTE (which didnt look like it worked in Blade, anyway), I tried running the example code and got the same socket error: 10061:

Connection refused.

No connection could be made because the target computer actively refused it. This usually results from trying to connect to a service that is inactive on the foreign host—that is, one with no server application running.

- I was considering calling Vicon about all the issues with Blade. However, as I was writing up a list and reviewing my resources for troubleshooting, I had a couple ideas about how to solve some of the issues: playing with thresholds. Rather than be told this over the phone, I set to work. Most significantly, increasing the strobe intensity of the cameras improved the capturing of markers in Blade, but many markers were still lost. However, the slight improvements came at regular intervals and, though minor, gave me a better understanding of the software as a whole.

-The bad connection was an incorrect port. After reading a lot of vague literature on the RTE (which, supposedly, always connects to port 800) and ip addresses and open streaming ports, I finally discovered that our RTE is on port 801. Significant!

Week 13 (Apr 26, 2009 – May 1, 2009) - Finetuning and debugging brushstrokes, creating presentation, and trying like hell to get ExampleClient successfully connecting and streaming data. No dice. Added color variance and got the Ink brush finally working, which varies radius with instantaneous velocity.

Week 14 (May 3, 2009 – May 8, 2009) - Looking up bvh v c3d v amc/asf

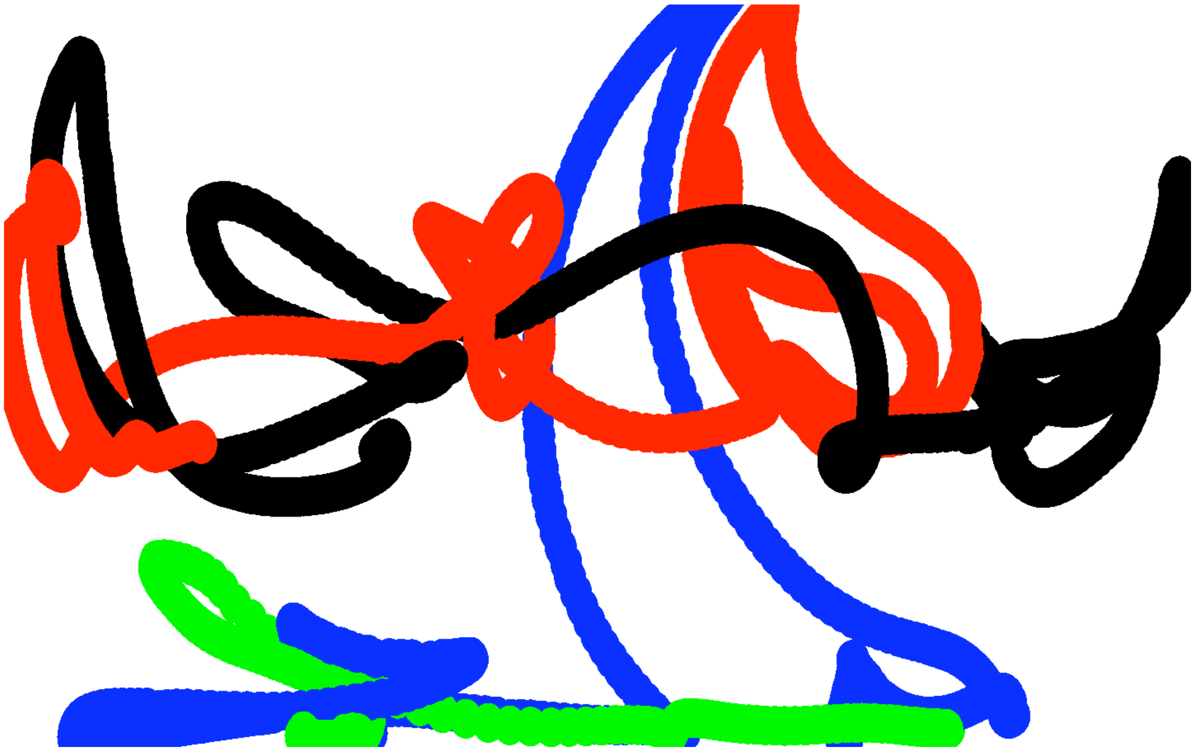
: I went with c3d (technically, an ascii txt converted from c3d). I actually nixed bvh and thought I was going to do asf/amc file pairing, but that data management got more and more complex, and so I figured, since I was having more issues parsing than I thought (I thought it'd be more straightforward, but I got held up in the tokenizing phase) and, therefore, need data that, though vague, is in the form I need. This will all be in the paper, but: the reason I first tried asf/amc is that the only c3d converter I could find for free does not label markers and, as I mentioned, c3d files add 100-300 markers to a standard marker set. Even when these are labeled in Blade, this c3d-ascii converter just labels them 1-numMarkers. I did find a trial of one other c3d converter, however, it is probably even more unreadable (by this I mean, harder to find salient data amidst the file) and I can only convert files of <=100 frames. So yeah. asf/amc are beautiful files to look at, but unwieldy to parse. I was ambitious and thought, figure out the basic unlabeled c3d, then try asf/amc and do some pretty math that I need to learn and tada, fancy project. Not so.

Week 15 (May 9, 2009 – May 13, 2009) Finally finished the ASCII txt c3d parser! It only works on CMU's marker set currently, but it successfully interprets those files! The code parses the file into frames, extracts the lines with the desired markers (4/330, it's a lot of data for little salient info), and tokenizes. Takes the x and y values f all four markers, stores them for that frame, and moves on to the next frame. Once you hit 'g' it draws under the current specifications.

I made one final change. I found the paintings from the x and z axes (z is the up vector) incredibly boring compared to the x and y plane. Perhaps it is because of the limits of the short motions, but these paintings generally had two areas of brushstroke – one toward the top and one toward the bottom, with a chunk missing in the middle. This is because these motions do not have many level changes – one kick, for example. These paintings look more like medical graphs than paintings. So, instead of yielding a vertical frame at the front of the space, the program currently provides a top-view painting – essentially, a trace of where you've been.

Pictures are included below.

Front view of 05_10:



Top view of 05_10: